



Analysis of polio vaccination coverage in the context of the anti-vaccine movement and the onset of the COVID-19 pandemic in the municipality of Piracicaba compared to Brazil

Análise da cobertura vacinal contra poliomielite no contexto do movimento antivacina e do início da pandemia de COVID-19, no município de Piracicaba em comparação com o Brasil

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ABSTRACT

Introduction: The Brazilian National Immunization Program is one of the most important preventive tools within the Brazilian Unified Health System. Poliomyelitis is a notifiable disease that was eliminated in Brazil through vaccination efforts that began in 1961, with the country being certified, in 1994, as wild poliovirus-free. However, the emergence and rise of the anti-vaccine movement in the country, combined with periods of governments adopting neoliberal policies that restricted health expenditures, pose a threat to vaccination coverage nationwide. **Objective:** The aim of this article was to compare polio vaccination data from Piracicaba with national data and to discuss the possible impacts of the anti-vaccine movement, misinformation (fake news), and the COVID-19 pandemic on local and national vaccination coverage. **Methods:** We conducted a retrospective longitudinal study through the analysis of secondary data on vaccination coverage in the city of Piracicaba, state of São Paulo, and Brazil between 2017 and 2022, obtained from the databases of the Regional Health Department of Piracicaba, the Information Technology Department of the Brazilian Unified Health System, and DATASUS. **Results:** Between 2017 and 2020, the Piracicaba region reported 3 suspected (but unconfirmed) cases of poliomyelitis and vaccination coverage ranging from 91.19% to 103.46% between 2017 and 2021. In contrast, southeastern Brazil recorded coverage rates between 73.11% and 90.04% during the same period. **Discussion:** Beginning in 2024, the Brazilian Ministry of Health gradually replaced the oral polio vaccine with the

RESUMO

Introdução: O Programa Nacional de Imunizações é uma das ferramentas de maior impacto no setor preventivo da medicina integrativa do Sistema Único de Saúde. A poliomielite é um dos componentes da lista de doenças de notificação compulsória, a qual foi extinta no Brasil devido à vacinação iniciada em 1961, obtendo em 1994 o certificado de área livre de circulação do vírus selvagem. Porém, o surgimento e crescimento do movimento antivacina no país, associado a um período de governos de políticas neoliberais com controle de gastos da área da saúde, mostram-se uma ameaça à cobertura vacinal em território nacional. **Objetivo:** Comparar dados vacinais da poliomielite de Piracicaba, SP, com os nacionais e discutir os possíveis impactos do movimento antivacina, das *fake news* e da pandemia de COVID-19 na cobertura vacinal local e federal. **Métodos:** Estudo longitudinal retrospectivo realizado por meio da análise de dados secundários de cobertura vacinal do município de Piracicaba, SP, e do Brasil entre os anos de 2017 a 2022 obtidos nas bases de dados do Departamento Regional de Saúde de Piracicaba, Departamento de Informática do Sistema Único de Saúde do Brasil e DATASUS. **Resultados:** A região de Piracicaba registrou entre 2017 e 2020, 3 casos notificados (mas não confirmados) de poliomielite e uma cobertura vacinal variando entre 91,19 e 103,46% entre os anos de 2017 e 2021; enquanto o Sudeste do Brasil registrou uma variação entre 73,11 e 90,04%, nesse mesmo período. **Discussão:** A partir de 2024, o Ministério da Saúde substituiu gradualmente a Vacina Oral Poliomielite pela versão inativada do imunizante,

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inactivated polio vaccine, based on new scientific evidence. These changes aimed to improve the effectiveness of the immunization schedule in light of epidemiological evidence. **Conclusion:** The influence and consequences of persistent misinformation against vaccination can be observed in both the pre- and post-COVID-19 pandemic periods.

Keywords: Poliomyelitis, anti-vaccination movement, COVID-19, vaccination coverage.

considerando novas evidências científicas. O objetivo dessas mudanças visa melhorar a eficácia do esquema vacinal frente aos indícios epidemiológicos. **Conclusão:** É possível perceber a interferência e as consequências das *fake news* persistentes contra a vacinação no período pré e pós-pandemia de COVID-19.

Descritores: Poliomielite, movimento contra vacinação, COVID-19, cobertura vacinal.

Introduction

One of the requirements of primary health care is comprehensiveness, which is also one of the directives of the Brazilian Unified Health System (SUS).¹ Its premise is ensuring the provision of comprehensive health care to all individuals, in alignment with the current World Health Organization (WHO) definition of health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” This enables SUS to ensure full treatment for patients in all their human complexity, more than just their biology, not reducing them to an isolated complaint.² In addition, comprehensiveness expands in the chronology of disease trajectory, encompassing prevention at all levels of care.³

The Brazilian National Immunization Program is one of the most important preventive tools within the SUS, coordinating and organizing national vaccination policy in its entirety, from immunization campaigns to vaccine cold chain management and adverse event reporting.⁴ The program operates in conjunction with the Brazilian Ministry of Health, as well as state and local health departments, overseeing the logistics of procurement and distribution of immunobiologicals as well as the collection of all immunization-related data.⁵ This data collection process is conducted through the National Immunization Program Information System, which includes doses administered and missed, movement of immunobiologicals, and adverse event reports.⁴ This gives Brazil a highly interconnected health system with access to information from across the country, since it integrates the different municipal health systems.

This preventive framework includes notifiable diseases, defined as conditions that may pose risks to public health, such as diseases with the potential to cause outbreaks or epidemics, illnesses or conditions of unknown cause, or diseases that lead to changes in the usual clinical-epidemiological

pattern of known diseases, taking into account their potential for dissemination, magnitude, severity, prevalence, and vulnerability in the population. Mandatory reporting of these diseases to health authorities is required whenever a suspected or confirmed case, condition, or public health event is identified. This reporting is conducted through the Information System for Notifiable Diseases (Sinan), which compiles all notifications, performs dynamic analyses of the occurrence of a given event in the observed population, and generates data for the development of its epidemiological profile. These data further inform the establishment of intervention priorities and the evaluation of their impact. Thus, its systematic and decentralized use contributes to the democratization of information, allowing all health care professionals to access and share data with the broader community.⁶

Poliomyelitis is a notifiable disease. It is a highly contagious disease caused by wild poliovirus, which destroys parts of the nervous system leading to permanent limb paralysis.⁷ Both children and adults can be infected, and transmission occurs through direct contact with the feces or oral secretions of infected individuals, making basic sanitation, housing conditions, and personal hygiene key factors in the spread of the virus. In general, symptoms include fever, malaise, headache, sore throat, body pain, vomiting, diarrhea, constipation, muscle spasms, neck stiffness, and in some cases, meningitis. In severe forms, it can cause flaccid paralysis, typically affecting one of the lower limbs, representing one of the main sequelae of poliomyelitis. There is no specific treatment for poliomyelitis; hospitalization and symptomatic management are recommended for all affected individuals.

Vaccination remains the most effective strategy to prevent poliomyelitis. The immunization schedule

consists of 3 doses of the inactivated poliovirus vaccine (IPV; types 1, 2, and 3) administered at 2, 4, and 6 months of age, followed by a booster dose at 15 months.⁸ With the introduction of polio vaccination in the 1950s, many countries have drastically reduced, or even completely interrupted, disease transmission,⁹ as was the case in Brazil, where the last confirmed case was reported in 1989. The Americas were declared polio-free in the 1990s.¹⁰

However, the emergence and rise of the anti-vaccine movement in Brazil, coupled with neoliberal policy agendas that restricted public health expenditures and reduced federal investment in health care,¹¹ pose a threat to polio vaccination coverage nationwide. In addition to substantially reducing investment in the SUS and, consequently, in the National Immunization Program,¹⁰ these administrations also created space for the proliferation of fake news about vaccines. Although the anti-vaccination movement has a centuries-long history, it has evolved and persisted over time. Records date back to 18th-century England, when Reverend Edmund Massey described vaccines as “diabolical operations,” and branded the practice of inoculation as sinful. In the 19th century, the National Anti-Vaccination League was established in London in strong opposition to compulsory vaccination on the grounds of personal liberty. In the 20th century, the movement gained further momentum following the publication of an article in *The Lancet* by former British physician and researcher Andrew Wakefield, which suggested an association between the measles, mumps, and rubella (MMR) vaccine and the onset of autism in young children.¹² Brazil has not escaped this long and persistent global history unscathed, experiencing a decline in overall vaccination coverage beginning in 2015. Following a nationwide mobilization effort in 2018, Brazil briefly regained protective immunization levels, but this progress was short-lived. In 2019, vaccination coverage declined sharply once again, and the situation worsened with the onset of the COVID-19 pandemic,¹⁰ a period marked by widespread dissemination of vaccine-related misinformation, amplified even by statements from the country’s then president, which contributed to legitimizing vaccine hesitancy.¹³

Given this context, the collection, quantification, and comparison of vaccination data from before and during the pandemic are essential for planning strategies and coordinated actions across all levels of government in order to restore previous levels of vaccination coverage.

Therefore, the aim of this study was to compare polio vaccination data from Piracicaba, São Paulo, with national data and to discuss the potential impacts of the anti-vaccine movement, misinformation (fake news), and the COVID-19 pandemic on both local and national vaccination coverage.

Methods

This retrospective longitudinal study analyzed secondary data on vaccination coverage in the city of Piracicaba, state of São Paulo, and in Brazil as a whole between 2017 and 2022. Data were obtained from the databases of SUS Regional Health Department of Piracicaba and the SUS Information Technology Department (DATASUS).

Data extracted from these databases included vaccination coverage rates, the completion of the vaccination schedule, region, and the number of reported poliomyelitis cases, when available.

From the Regional Health Department of Piracicaba, information was obtained from an Excel spreadsheet titled “DADOS_BOLETIMSE1A52_2021.xlsx.” The “Casos Pólio” tab utilizes the Brazilian Institute of Geography and Statistics (IBGE) codes 352690 and 353870, both referring to the municipality of Piracicaba; the first corresponds to notifications made in the city of Limeira, the second to notifications in Piracicaba itself. The spreadsheet also includes the number of reported cases for the years 2019, 2020, 2021, and 2022.

In the “Cobertura Vacinal Polio” tab, the IBGE code 353870 was used, corresponding to the same municipality and to polio vaccination coverage with the oral poliovirus vaccines 1 and 3 (OPVb) and IPV types 1, 2, and 3 in children under 2 years of age who had completed the full vaccination schedule (3 doses plus 1 booster) between 2017 and 2021. These correspond to the data extracted on March 9, 2022, while those for 2020 and 2021 are marked as “subject to change.”

Polio vaccination coverage in Piracicaba was analyzed starting from 2017 to provide a benchmark preceding 2019 and the onset of the COVID-19 pandemic, both moments associated with intense dissemination of misinformation about vaccination.

From DATASUS, within the “Assistência à Saúde” (“Health Care”) tab, the “Imunizações — desde 1994 — Cobertura” (“Immunizations — since 1994 — Coverage”) path was selected. The following parameters were applied: Linha: Ano; Coluna: Região;

Medidas: Imuno - Poliomielite, poliomielite 4 anos, and poliomielite (1° reforço); Períodos disponíveis: De 2010 a 2022; Seleção disponível: Nenhuma seleção; Gráfico: Coluna (Row: Year; Column: Region; Measures: Immunization – Poliomyelitis, poliomyelitis (age 4), and poliomyelitis [1st booster]; Available periods: 2010 to 2022; Selection: None; Graph type: Column chart).

The period from 2017 to 2022 was chosen to assess the impact of the growing anti-vaccination movement in Brazil, which, as discussed in the Introduction, began to have a significant influence around 2014–2015.

Results

The data collected from the Regional Health Department of Piracicaba are shown in Table 1. The incidence by reported case in the municipalities of Piracicaba and Limeira was low, totaling 3 cases over a 6-year period. Although reported, these cases were investigated and categorized as acute flaccid paralysis, not as poliomyelitis caused by wild poliovirus.

Table 2 presents data collected from IBGE, under code 353870, showing variations in vaccination coverage in Piracicaba over the study period. Decreases were observed in 2017, 2019, and 2021, with the lowest coverage rate in the most recent of these 3 years.

Table 1

Reported poliomyelitis cases in the municipality of Piracicaba, São Paulo, between 2017 and 2022

IBGE code	Reporting GVE	Reporting municipality	Number of reported cases					
			2017	2018	2019	2020	2021	2022
352690	Piracicaba	Limeira			1	1		
353870	Piracicaba	Piracicaba			1			

GVE: Grupo de Vigilância Epidemiológica (Epidemiological Surveillance Group).

Source: Regional Health Department of Piracicaba, São Paulo.

Tabela 2

Polio vaccination coverage (oral poliovirus vaccine types 1 and 3 [attenuated] [OPVb] and inactivated poliovirus vaccine types 1, 2, and 3 [IPV]) in the municipality of Piracicaba, São Paulo, between 2017 and 2021, in percentage

IBGE code	City	2017	2018	2019	2020 ^a	2021 ^a
353870	Piracicaba	93.75	103.46 ^b	95.55	98.87	91.19

^a Data subject to changes.

^b The target population for vaccination is estimated annually, and the vaccination target is set at 95%. However, population mobility, especially in tourist cities such as Piracicaba, can affect the accuracy of these estimates, sometimes exceeding 100%, as seen in this case.

Source: IBGE.

From DATASUS, using the parameters described in the Methods section, the study collected the data shown in Figure 1 and Table 3, indicating that Brazil's overall vaccination coverage, including all states, declined progressively over the years until 2021, and began increasing again in 2022.

Discussion

The data presented in this study indicate that polio vaccination coverage in Brazil remained steady, with only minor fluctuations between 2010 and 2015. However, beginning in 2016, a gradual decline in coverage was observed, coinciding with periods of greater dissemination of misinformation about vaccines and health more broadly, as well as the onset and peak of the COVID-19 pandemic.

According to the WHO, the pandemic was accompanied by a wave of excess information, not always accurate, making it increasingly difficult to identify reliable sources and trustworthy guidance. This vulnerable environment was also characterized by the widespread dissemination of fake news and misinformation,¹⁴ fostering fear and vaccine hesitancy in the population.¹⁵ Additional factors contributing to the decline in vaccination coverage during this period included limited access to vaccination services during lockdowns,¹⁶ logistical challenges in vaccine production, transportation, and distribution across

the country,¹⁷ and the psychological impact of the pandemic, which led many individuals to deprioritize vaccination.¹⁸

These events were associated with disruptions in a long-standing pattern of vaccination coverage that had served for years as a global benchmark. This trend is especially evident at the regional and municipal level, as observed in Piracicaba, a municipality located in one of Brazil's most economically developed regions, characterized by highest levels of investment in health, technology, infrastructure, and sanitation. Despite these favorable conditions, suspected poliomyelitis cases were reported in 2019 and 2020, and vaccination coverage reached 91.19% in 2021; while high, this rate is still considered insufficient for population-level protection. Polio vaccination coverage data from 2023 and January–September 2024 show a continued downward trend, with alarming rates of 86.48% and 86.95%, respectively.

The reemergence of a dangerous disease once eradicated at the national level, accompanied by new cases and even deaths, underscores the paradox of a modern era defined by unprecedented access to scientific and public health knowledge, yet undermined by a barrage of exaggerations and the proliferation of fake news.

In 2024, the Brazilian Ministry of Health initiated the gradual replacement of the OPV with the IPV, in line with emerging scientific evidence. This change

Table 3

Polio vaccination coverage (oral poliovirus vaccine types 1 and 3 [attenuated] [OPVb] and inactivated poliovirus vaccine types 1, 2, and 3 [IPV]) by Brazilian region over 6 years, in absolute numbers (data updated as of June 29, 2023)

Region	2017	2018	2019	2020	2021	2022	Total
Total	84.74	89.54	84.19	76.79	71.04	77.20	80.64
North Region	75.67	77.06	79.59	65.69	62.29	71.23	71.92
Northeast Region	81.92	90.04	82.73	73.11	68.53	78.50	79.13
Southeast Region	87.56	92.66	84.54	78.28	71.53	75.14	81.77
South Region	89.82	89.91	89.04	86.50	79.98	83.10	86.44
Central-West Region	84.44	88.59	85.40	80.47	74.22	80.50	82.26

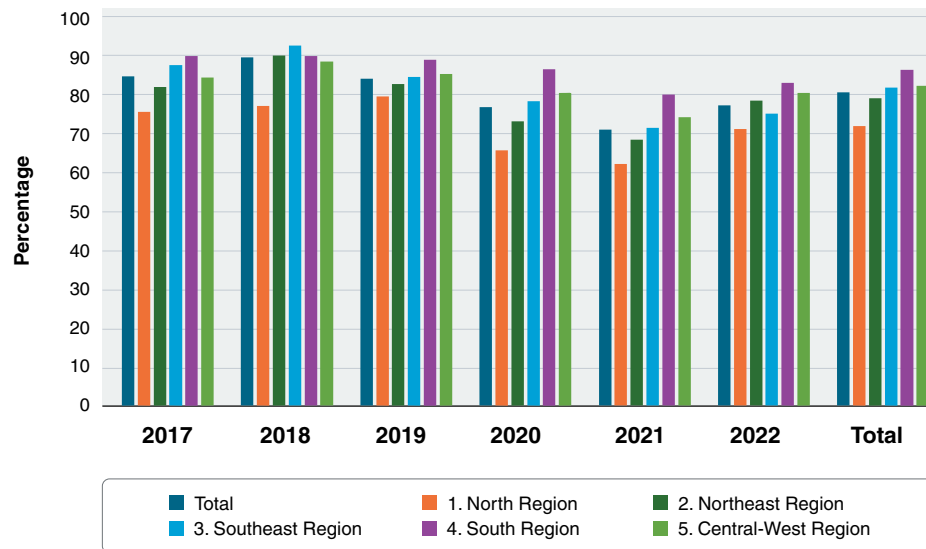


Figure 1

Polio vaccination coverage by Brazilian region over 6 years (data updated on 06/29/2023)

Source: DATASUS.

was discussed in a meeting of the Technical Advisory Committee on Immunization, which brought together representatives from all regions of Brazil with the goal of restoring national vaccination coverage to high levels.¹⁹ Since the first half of 2024, Brazil has adopted IPV exclusively for the booster dose administered at 15 months of age, replacing the oral formulation. Injectable IPV is already part of the national vaccination schedule at 2, 4, and 6 months of age. The booster dose currently administered at 4 years of age will be discontinued, as the 4-dose schedule ensures full protection against poliomyelitis.¹⁹

Although the OPV has been extremely effective in controlling poliomyelitis for decades, the evolution of vaccination strategies recommended by the WHO²⁰ and concerns related to safety and maintenance of disease eradication²¹ have justified the Brazilian Ministry of Health's decision to adopt IPV as the primary vaccine in the country.

Conclusion

A clear association emerges between the infodemic and the dissemination of misinformation, particularly through the spread of fake news during

the pre- and post-pandemic periods, and the decline in vaccination coverage, particularly for diseases previously eradicated in Brazil, such as poliomyelitis. Consequently, this has increased the population's vulnerability to preventable diseases.

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No conflicts of interest declared concerning the publication of this article.

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